

**METHOD OF PRODUCING A MANUFACTURED ARTICLE IN SILK  
INDICATED IN THE TREATMENT OF SOME SKIN DISEASES  
OF THE HUMAN BODY**

RELATED U.S. APPLICATIONS

Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED  
RESEARCH OR DEVELOPMENT

Not applicable.

REFERENCE TO MICROFICHE APPENDIX

Not applicable.

FIELD OF THE INVENTION

[0001] The present invention relates to a method for producing a manufactured article in silk indicated in the treatment of some skin diseases of the human body.

[0002] The proposed invention finds particular but not exclusive application in the area of specialist products for use in the health sector intended for complementing drug therapy for the treatment of atopic dermatitis.

BACKGROUND OF THE INVENTION

[0003] Skin diseases, a classic example of which is dermatitis, are well known.

[0004] In subjects who unfortunately suffer from them, they cause skin irritation which can sometimes be localized, while in many circumstances it may be diffused, affecting almost the whole body.

**[0005]** It is certainly a considerable problem, since obviously the part affected by the pathology, as well as usually being treated with suitable drugs, must also be protected as well as possible. Protection is thus an essential aspect, not only for promoting regeneration of the skin, but especially to prevent the phenomenon being aggravated or, worse, being repeated. It can in fact happen that through inadequate protection, bacterial colonies develop, giving rise to repeated troublesome and dangerous infections that slow the course of the disease. It must not be forgotten, moreover, that skin infections are among the most recurrent pathologies as a consequence of severe dermatitis.

**[0006]** The same may be said of other pathologies, for example diabetic foot, or even more so in the case of the treatment of burns. Ultimately, in these and other circumstances, always with the same protective aim, it is necessary to proceed by wearing or fitting special articles of clothing, bandages or even just sheaths.

**[0007]** For example, the problem is tackled in DE4101580 (Faeth), suggesting for some pathologies the making of an article of clothing for night wear, which comprises a so-called overall, which is completely closed with respect to the ends of the sleeves and legs. The overall is in this case made from a cotton textile which is compatible with the skin.

**[0008]** In any case, in addition to articles of clothing, elastic bandages for medication are also known, which are currently made of commercially available fabrics. Both the concepts of stretch fabric or extensible fibre and elastic article of clothing are not novel in themselves and so are available in many different types. Fabrics that absorb moisture are also known and are not novel. Many of these manufactured articles are made, for example, from material of elastic synthetic fibre, like Lycra (TM) (a registered trademark of DuPont de Nemours & Co.), and are characterized by elongation of the elastomer of at least 500-600%. For making articles of clothing, this material is

never used on its own, but is always combined with other fibers, for example polyesters, cotton, nylon, and others that are commercially available. Various methods are used for making the fabric, depending on the different compositions, and tricot, for example, is quite widely used for knitted goods.

**[0009]** US6063049 (Watkins) proposes protective clothing, particularly for post-operative use, obtained from two layers of woven material, each one obtained by combining a polyester fibre with a second fibre of an elastic type. The fabric has an elasticity of approx.  $200-220 \pm 10\%$  in the two directions of the weft and warp, with a tolerance relative to the latter between 3% and 5%. This fabric is further characterized by a modular compression from approx. 1 to approx. 4, with good capacity for transpiration, which leads to loss of a percentage humidity close to 70-100%, in 30 min.

**[0010]** These and other solutions not yet described are certainly valuable, though a significant fact is that the aforementioned articles are only intended to protect the skin against contact, but not also achieve antimicrobial objectives.

#### **[0011] STATE OF THE ART RELATIVE TO THE INVENTION**

**[0012]** The properties of silk are known from the literature. An excellent fibre, it has always been used for making traditional articles of clothing, from shirts to stockings, and other accessories as well.

**[0013]** It is also known that some subjects have the aim of imparting antimicrobial objectives to a fabric, particularly for the treatment of some skin diseases.

**[0014]** This is so in the case of CN1044964 (Wang), which tackles the problem of the transmission of dermatitis through contact with fabrics. In more detail, it is proposed to make a non-woven fabric, which uses acrylic fibers modified by a chemical treatment, stretched to give a uniform, antiseptic

and anti-odor fibre combined with a polyester or viscose fibre and polypropylene fibre, subsequently structured as a network and then treated with acrylate latex. This fabric would, according to the drafter, lend itself to the manufacture in particular of hygienic absorbents, with anti-inflammatory and anti-pruritus properties, and with functions of health protection, e.g. protection against softening of the skin, dermatitis and other skin disorders.

[0015] The applicant has also obtained brief information regarding application CN1211652 (Yutang). It is known that this deals with a fabric for preventing allergic asthma caused by dust from mites. In essence it appears that the fabric is treated with an emulsion consisting of acaricide, adhesive and filling water. This fabric seems to be indicated in particular for making mattress stuffing and bedspreads, as well as for treating allergic rhinitis, allergic dermatitis and conjunctivitis, caused by mites.

#### [0016] DRAWBACKS

[0017] Although the proposed solutions meet their individual objectives, they are generally considered to be insufficient, as they are unable to offer a material, in particular a fabric, with good therapeutic and antiseptic properties.

[0018] From the structural standpoint, the fibers or the material thus obtained are not flexible and cannot be cleaned properly, as a fabric should that is used for making clothing that is especially comfortable and at the same time has high capacity for ensuring hygienic conditions.

[0019] With regard to the finished articles of clothing, especially with reference to the solution proposed by DE4101580 (Faeth), in addition to the circumstances mentioned above, the fact that they are made of cotton does not prevent irritation of the skin, because the short cotton fibers absorb and give up moisture, elongating and contracting continually, causing a constant rubbing action on

the skin, thus contributing to further irritation of the skin that is already affected by other troubles. Its hygroscopic capacity is therefore limited, producing a sensation of dampness for long periods.

**[0020]** Accordingly, there is clearly a need to find alternative solutions with greater functionality than those currently available or deducible.

**[0021]** The aim of the present invention is therefore to offer an optimum solution of technical fabric for making articles of clothing, intended for the health care sector, for therapeutic and antiseptic purposes.

### BRIEF SUMMARY OF THE INVENTION

**[0022]** This and other aims are achieved with the present innovation according to the characteristics as in the appended claims, solving the problems described by means of a method for obtaining a manufactured article, particularly in silk, indicated for the treatment of skin diseases of the human body, in which the following stages are envisaged:

- a. making the manufactured article, carrying out manufacture with raw, untreated and degummed silk;
  - b. immersing the manufactured article thus obtained in a bath comprising a composition based on quaternary ammonium, combined with a catalyst that polymerizes on the fibers;
  - c. drying;
  - d. any required coloring of the manufactured article thus obtained,
- which can also be carried out prior to stage (b);
- and in which the manufactured article consists of an article of clothing particularly suitable for

children, in the form of a therapeutic romper suit or overalls, in knitted silk, integrating portions of knitwear that cover the ends of the upper and lower limbs, which provides, corresponding to the aforesaid ends, openings like buttonholes for the temporary emergence of the hands and of the feet.

#### **[0023] ADVANTAGES**

**[0024]** Certain objectives are thus achieved, through the considerable creative contribution, whose effect constitutes an immediate technical advance.

**[0025]** Firstly it should be pointed out that the manufactured article thus produced has the benefit of a substrate, namely silk, whose exceptional qualities are known. More particularly, it is non-allergenic and non-irritant, it allows transpiration, it has a thermoregulating function so that it reduces sweating, there are no electrostatic charges, it does not emit odors, it does not support mildew and moths, it is non-felting, it does not shrink, it is strong and flexible and, finally, it can be washed with neutral shampoo. There are no known applications intended as it were for therapeutic use. For example, in the solutions mentioned earlier, the fibers used in the manufacture of an article of clothing are either of a synthetic type or of a natural type, but in the latter case only cotton is used, see for example the observations with reference to the proposal in DE4101580 (Faeth). Among the more significant characteristics, relating to the silk substrate only, there is the fact that the article of clothing made of knitted silk possesses considerable hygroscopic capacity, because when the extremely long, degummed silk threads absorb and give up moisture they do so by increasing and decreasing their diameter, without causing irritation of the sensitive skin. As well as maintaining the water balance of the skin, this phenomenon also exerts other positive effects on the epidermis, a particular benefit being that it produces micro-massaging that causes local activation of the cells, further promoting their regeneration.

**[0026]** Since the silk has also been treated with an antimicrobial product, the manufactured article thus obtained also offers other benefits. In more detail, as well as constituting an excellent barrier to skin irritation and excoriation by providing active protection of the damaged horny layer, it controls the development of bacteria (especially *Staphylococcus aureus*) and greatly reduces the possibility of infection. Overall, therefore, it can be stated that the present manufactured article is particularly indicated, as well as for treating and curing dermatitis, in the treatment of burns by aiding regeneration of the skin, in female personal care for treatment of candidiasis, and in the treatment of cutaneous manifestations of diabetes, such as diabetic foot.

**[0027]** Furthermore, its function is permanent, in contrast to the other solutions, which have a function of limited duration.

**[0028]** As for the specific advantages of rompers in knitted silk treated by the method described above, it can be seen that, owing to the individual openings provided corresponding to the extremities, they permit the hands and/or the feet to come out, with obvious benefits for the subject being treated and for his carers. Yet another advantage is that the rompers are made with all the seams on the outside, which offers the benefit of a significant reduction of the effect of friction on the skin.

**[0029]** To summarize, a manufactured article can be produced that is provided with good technological content, combining as many functions as possible.

**[0030]** These and other advantages will become clear from the following detailed description of at least one preferred embodiment with the aid of the appended schematic drawings, the details of execution of which are not intended to be limiting, but are only given by way of an example.

## BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0031] Figure 1 is a front view of a manufactured article in silk, treated according to the present invention with an antimicrobial agent, in particular a romper suit for babies.

[0032] Figure 2 is a back view of the romper suit for babies as in Fig. 1.

[0033] Figure 3 is, finally, a block diagram of a method of manufacture for producing a manufactured article, treated with an antimicrobial agent.

## DETAILED DESCRIPTION OF THE INVENTION

[0034] The present invention relates to a method for producing a manufactured article in silk indicated in the treatment of skin diseases of the human body, and an article of clothing in silk thus obtained, treated with an antimicrobial agent.

[0035] In this particular case, the successive stages for carrying out the aforementioned method require, firstly, the availability of fibers of raw, and hence untreated, natural silk. This presumes, essentially, that the fibre is degummed, in an operation that provides removal of the gum.

[0036] Stage (a).

The article of clothing (1), for example, is obtained using the said fibers of raw silk, which can if necessary be coated with a lubricant, for example oil.

[0037] Stage (b).

A liquid bath is provided, at a temperature of approx. 25°C, to which an antimicrobial solution has been added. The said solution is composed of an antimicrobial agent based on quaternary ammonium, and more specifically of the type identified in the product ÆGIS Dow Corning 5700 (3-trimethoxysilylpropyldimethyloctadecyl ammonium chloride) marketed by ÆGIS



Environmental Management, Inc., previously dissolved in a percentage of water with the addition of SILANE (from the family of silicone softeners) as binder. The percentage of the ÆGIS antimicrobial agent in the solution is approx. 8% per 1 kilogram of dry fabric or article to be treated. As a rule, therefore, 30-35 kg of solution is required per 1 kg of fabric to be treated. The article of clothing (1), once immersed, is kept in motion, and the liquid environment in which it is immersed with a pH of 5 is raised first to a temperature of 30° and then to 50°C with pH 8, for a total time of 45-60 minutes.

**[0038]** Stage (c)

Next the fabric or the article (1) thus treated is submitted to drying, in a cycle of centrifugation.

**[0039]** Stage (d)

The final stage is coloring, which in one case can also be carried out before stage (b).

**[0040]** Significantly, excellent results have also been obtained using raw materials other than silk, such as non-woven fabric, synthetic or acrylic fibers, and even polypropylene.

**[0041]** Some tests were also carried out with the aim of verifying the effectiveness of the treatment on the fibre submitted to the process described above. For example, test report No. 010327/1 dated 27.07.2001 issued by the Experimental Station, analysis service of the Milan Polytechnic, is interesting. This was carried out using test method AATCC 147-1998:

microorganisms: *Staphylococcus aureus* ATCC 6538

inoculum: parallel stripes are made of a liquid culture of *S. aureus* on whole agar

contact time and temperature: 24h at 37°C

quantity of sample tested: testpieces of fabric with the dimensions 3 cm x 5 cm

sterilization of the sample: none

## RESULTS

	INHIBITION HALO	GROWTH UNDER THE TESTPIECE	GROWTH ON THE FABRIC (**)
TREATED SAMPLE	ABSENT (*)	ABSENT	ABSENT
UNTREATED SAMPLE	ABSENT (*)	PRESENT	PRESENT

(\*) : continuous growth of bacteria around the testpiece of fabric

(\*\*) : on the testpiece side in contact with the agar

**[0042]** After 24 h of incubation of the plates, formation of a halo of growth inhibition was not observed, indicating that antimicrobial product is not released into the agar from the treated sample.

**[0043]** A possible application of the treated fabric, as has been mentioned, is for making an article of clothing (1), in this particular case a romper suit made of knitted silk for babies, suitable in particular for the treatment of atopic dermatitis. This is an article of clothing that covers the human body almost completely, apart from the neck and the head. It consists of a central part, the body (10), and four appendages, namely two (11) to form the sleeves, made diametrically opposite at shoulder height, and two (12) almost parallel, involving the lower part of the central body (10), for covering the subject's legs. All four appendages have an end portion (110, 120), closed like a mitten or like a sock, as appropriate, which being an integral part of the sleeve (11) or of the leg (12), completely covers the limb in question, i.e. the hand or the foot. The main characteristic of the said article of

clothing (1) is that it provides openings (13), each made in a reversed position, relative to the end of the appendages (11, 12). The said openings (13), made like a buttonhole, make it possible for the child's caregiver to bring the child's hands or feet out through the openings, even if only temporarily, so as to allow a certain freedom of movement, but without interrupting the treatment.

**[0044]** Another important point is that, as a consequence of the finishing process of the article of clothing (1), all the seams (14) are on the outside of the romper suit (1), so as to provide a substantially smooth and even internal surface, without any irritating surfaces. Finally, with regard to the wearability of the article of clothing, at the back it is provided with two intersecting openings made along the vertical axis and the horizontal axis, the overlapping flaps of which are closed using ordinary fastening means.